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KB3408

1.5MHz, **350mA** Synchronous Step-Down Regulator in SOT23-5

FEATURES

- **High Efficiency: Up to 96%**
- **Very Low Quiescent Current: Only 20μA During Operation**
- **350mA Output Current**
- **2.5V to 7.4V Input Voltage Range**
- **1.5MHz Constant Frequency Operation**
- **No Schottky Diode Required**
- **Low Dropout Operation: 100% Duty Cycle**
- **0.6V Reference Allows Low Output Voltages**
- **Shutdown Mode Draws ≤ 1μA Supply Current**
- **Current Mode Operation for Excellent Line and Load Transient Response**
- **Overtemperature Protected**
- **Low Profile (1mm) SOT23-5 Package**

APPLICATIONS

- **Cellular Telephones**
- **Personal Information Appliances**
- **Wireless and DSL Modems**
- **Digital Still Cameras**
- **MP3 Players**
- **Portable Instruments**

DESCRIPTION

The KB3408 is a high efficiency monolithic synchronous buck regulator using a constant frequency, current mode architecture. The device is available in an adjustable version and fixed output voltages of 1.8V and 3.3V. Supply current during operation is only 20μA and drops to ≤1μA in shutdown. The 2.5V to 7.4V input voltage range makes the KB3408 ideally suited for single Li-Ion battery-powered applications. 100% duty cycle provides low dropout operation, extending battery life in portable systems. Automatic Burst Mode operation increases efficiency at light loads, further extending battery life.

Switching frequency is internally set at 1.5MHz, allowing the use of small surface mount inductors and capacitors.

The internal synchronous switch increases efficiency and eliminates the need for an external Schottky diode. Low output voltages are easily supported with the 0.6V feedback reference voltage. The KB3408 is available in a low profile (1mm) SOT23-5 package.

TYPICAL APPLICATION

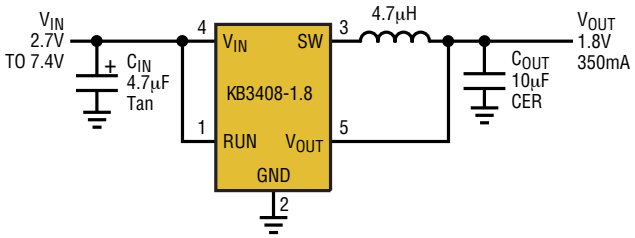


Figure 1a. High Efficiency Step-Down Converter

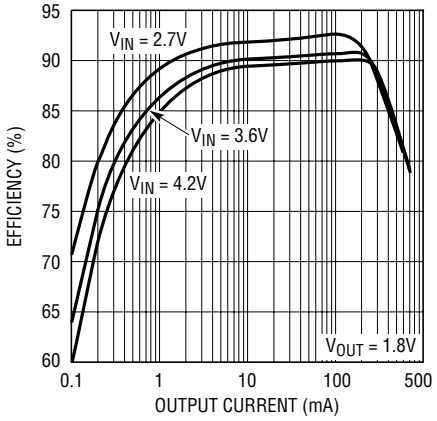
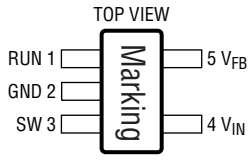


Figure 1b. Efficiency vs Load Current

ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Supply Voltage ..... −0.3V to 7.5V
RUN, V_{FB} Voltages ..... −0.3V to V_{IN}
SW Voltage ..... −0.3V to (V_{IN} + 0.3V)
P-Channel Switch Source Current (DC) 400mA
N-Channel Switch Sink Current (DC) 400mA
Peak SW Sink and Source Current 350mA
Operating Temperature Range (Note 2) .. −40°C to 85°C
Junction Temperature (Note 3) ..... 125°C
Storage Temperature Range ..... −65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACkAGE/ORDER INFORMATION



S5 PACKAGE
5-LEAD PLASTIC TSOT-23

T_{JMAX} = 125°C, θ_{JA} = 250°C/W, θ_{JC} = 90°C/W

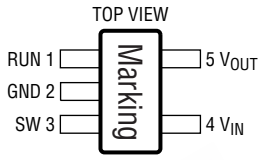
ORDER PART NUMBER

KB3408-ADJ

Top Marking

A19x

x: DateCode



S5 PACKAGE
5-LEAD PLASTIC TSOT-23

T_{JMAX} = 125°C, θ_{JA} = 250°C/W, θ_{JC} = 90°C/W

ORDER PART NUMBER

KB3408B-1.8

Top Marking

XXXX

KB3408B-3.3

Top Marking

XXXX

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are T_A = 25°C. V_{IN} = 3.6V unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
I_{VFB}	Feedback Current		●			±30	nA
V_{FB}	Regulated Feedback Voltage	KB3408 (Note 4) T_A = 25°C KB3408 (Note 4) 0 °C T_A ≤ 85°C KB3408 (Note 4) −40 °C ≤ T_A ≤ 85°C	 ●	0.5880 0.5865 0.5850	0.6 0.6 0.6	0.6120 0.6135 0.6150	V V V
ΔV_{FB}	Reference Voltage Line Regulation	V_{IN} = 2.5V to 7.4V (Note 4)	●		0.4	1	%/V
V_{OUT}	Regulated Output Voltage	KB3408-1.8, I_{OUT} = 100mA KB3408-3.3, I_{OUT} = 100mA	● ●	1.755 3.246	1.800 3.300	1.845 3.354	V V
ΔV_{OUT}	Output Voltage Line Regulation	V_{IN} = 2.5V to 7.4V	●		0.4	1	%/V
I_{PK}	Peak Inductor Current	V_{IN} = 3V, V_{FB} = 0.5V or V_{OUT} = 90%, Duty Cycle < 35%		0.40	0.45	0.5	A
$V_{LOADREG}$	Output Voltage Load Regulation				0.5		%
V_{IN}	Input Voltage Range		●	2.5		7.4	V
I_S	Input DC Bias Current Active Mode Sleep Mode Shutdown	(Note 5) V_{FB} = 0.5V or V_{OUT} = 90%, I_{LOAD} = 0A V_{FB} = 0.62V or V_{OUT} = 103%, I_{LOAD} = 0A V_{RUN} = 0V, V_{IN} = 4.2V			 250 20 0.1	 400 35 1	 µA µA µA
f_{OSC}	Oscillator Frequency	V_{FB} = 0.6V or V_{OUT} = 100% V_{FB} = 0V or V_{OUT} = 0V	●	1.2	1.5 210	1.8	MHz kHz
R_{PFET}	$R_{DS(ON)}$ of P-Channel FET	I_{SW} = 100mA			0.4	0.5	Ω
R_{NFET}	$R_{DS(ON)}$ of N-Channel FET	I_{SW} = −100mA			0.35	0.45	Ω
I_{LSW}	SW Leakage	V_{RUN} = 0V, V_{SW} = 0V or 5V, V_{IN} = 5V			±0.01	±1	µA

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are T_A = 25°C. V_{IN} = 3.6V unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{RUN}	RUN Threshold		●	0.3	1	1.5	V
I_{RUN}	RUN Leakage Current		●		±0.01	±1	μA

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: The KB3408 is guaranteed to meet performance specifications from 0°C to 70°C. Specifications over the –40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

Note 3: T_J is calculated from the ambient temperature T_A and power dissipation P_D according to the following formula:

KB3408: $T_J = T_A + (P_D)(250°C/W)$

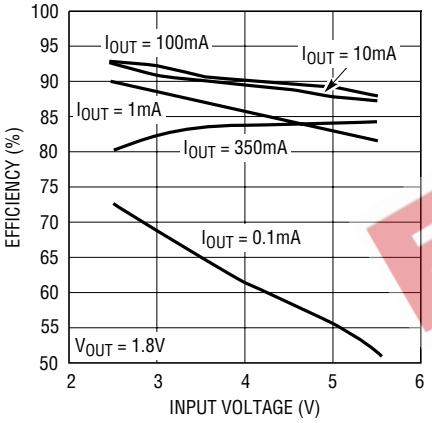
Note 4: The KB3408 is tested in a proprietary test mode that connects V_{FB} to the output of the error amplifier.

Note 5: Dynamic supply current is higher due to the gate charge being delivered at the switching frequency.

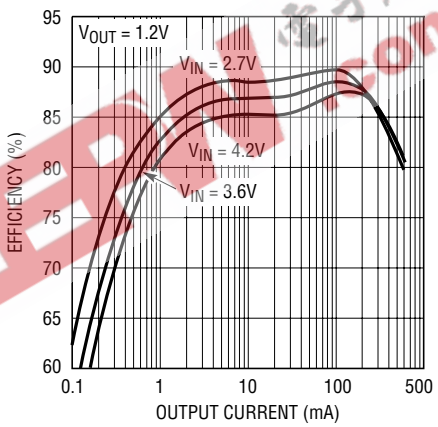
TYPICAL PERFORMANCE CHARACTERISTICS

(From Figure1a Except for the Resistive Divider Resistor Values)

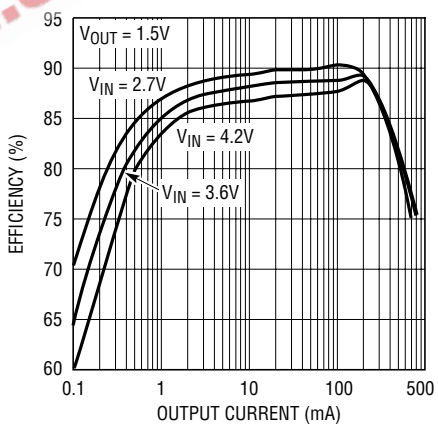
Efficiency vs Input Voltage



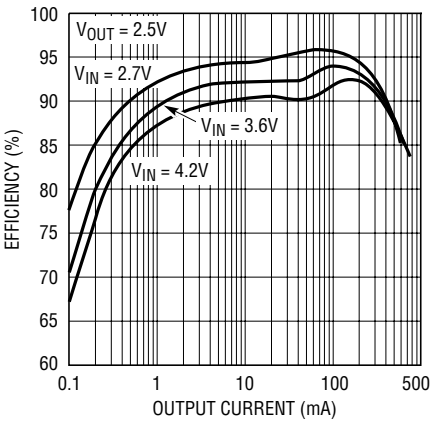
Efficiency vs Output Current



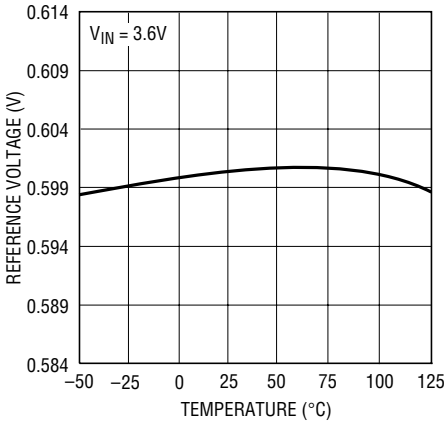
Efficiency vs Output Current



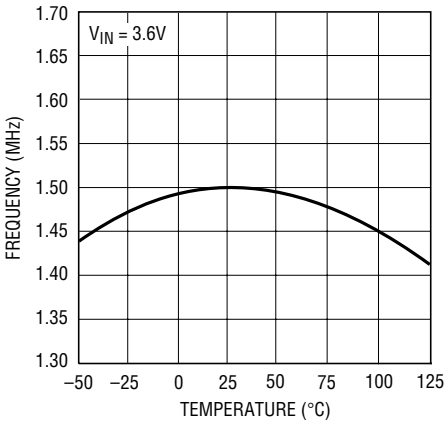
Efficiency vs Output Current



Reference Voltage vs Temperature



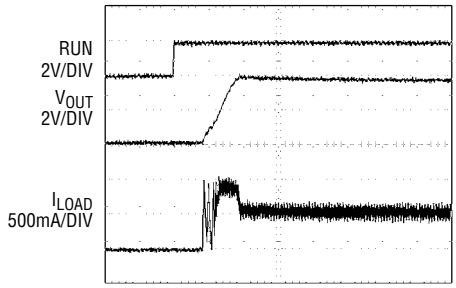
Oscillator Frequency vs Temperature



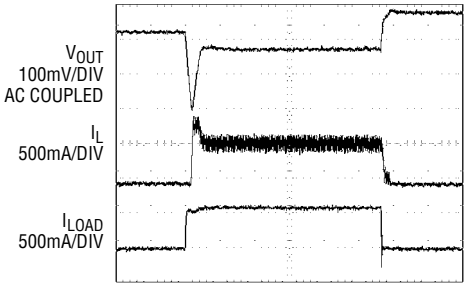
TYPICAL PERFORMANCE CHARACTERISTICS

(From Figure 1a Except for the Resistive Divider Resistor Values)

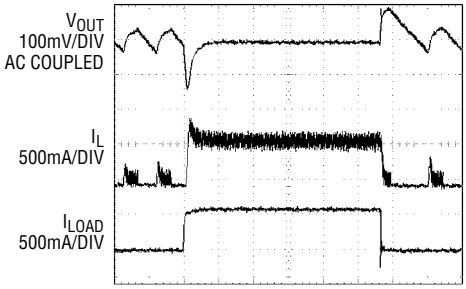
Start-Up from Shutdown



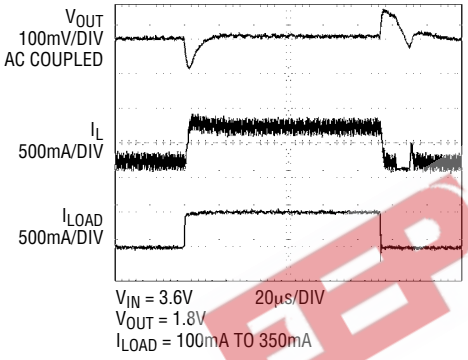
Load Step



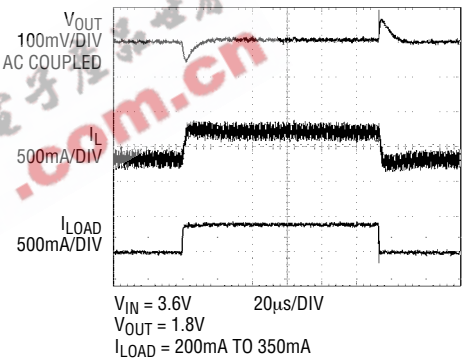
Load Step



Load Step



Load Step



PIN FUNCTIONS

RUN (Pin 1): Run Control Input. Forcing this pin above 1.5V enables the part. Forcing this pin below 0.3V shuts down the device. In shutdown, all functions are disabled drawing <1µA supply current. Do not leave RUN floating.

GND (Pin 2): Ground Pin.

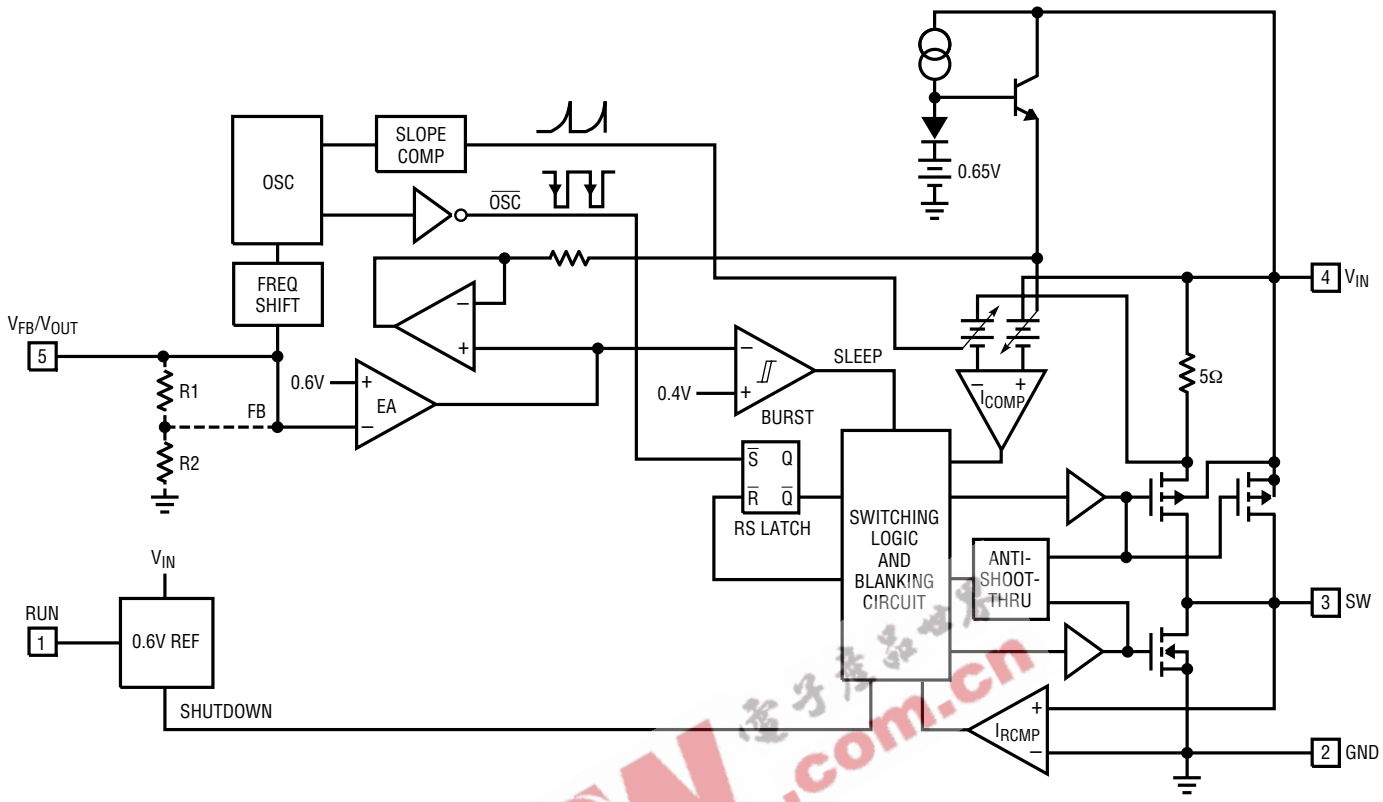
SW (Pin 3): Switch Node Connection to Inductor. This pin connects to the drains of the internal main and synchronous power MOSFET switches.

V_{IN} (Pin 4): Main Supply Pin. Must be closely decoupled to GND, Pin 2, with a 2.2µF or greater ceramic capacitor.

V_{FB} (Pin 5) (kB3408): Feedback Pin. Receives the feedback voltage from an external resistive divider across the output.

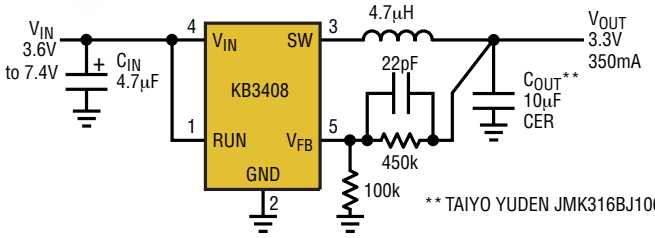
V_{OUT} (Pin 5) (kB3408-1.8/kB3408-3.3): Output Voltage Feedback Pin. An internal resistive divider divides the output voltage down for comparison to the internal reference voltage.

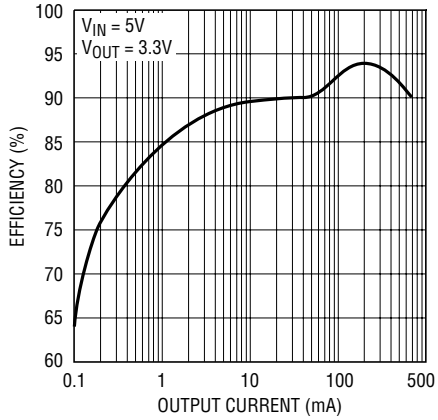
SIMPLIFIED BLOC DIAGRAM

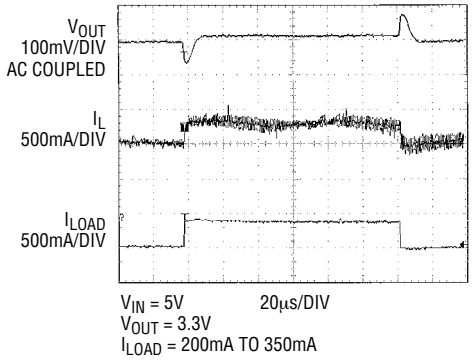


TYPICAL APPLICATION

Tiny 3.3V/350mA Buck Regulator

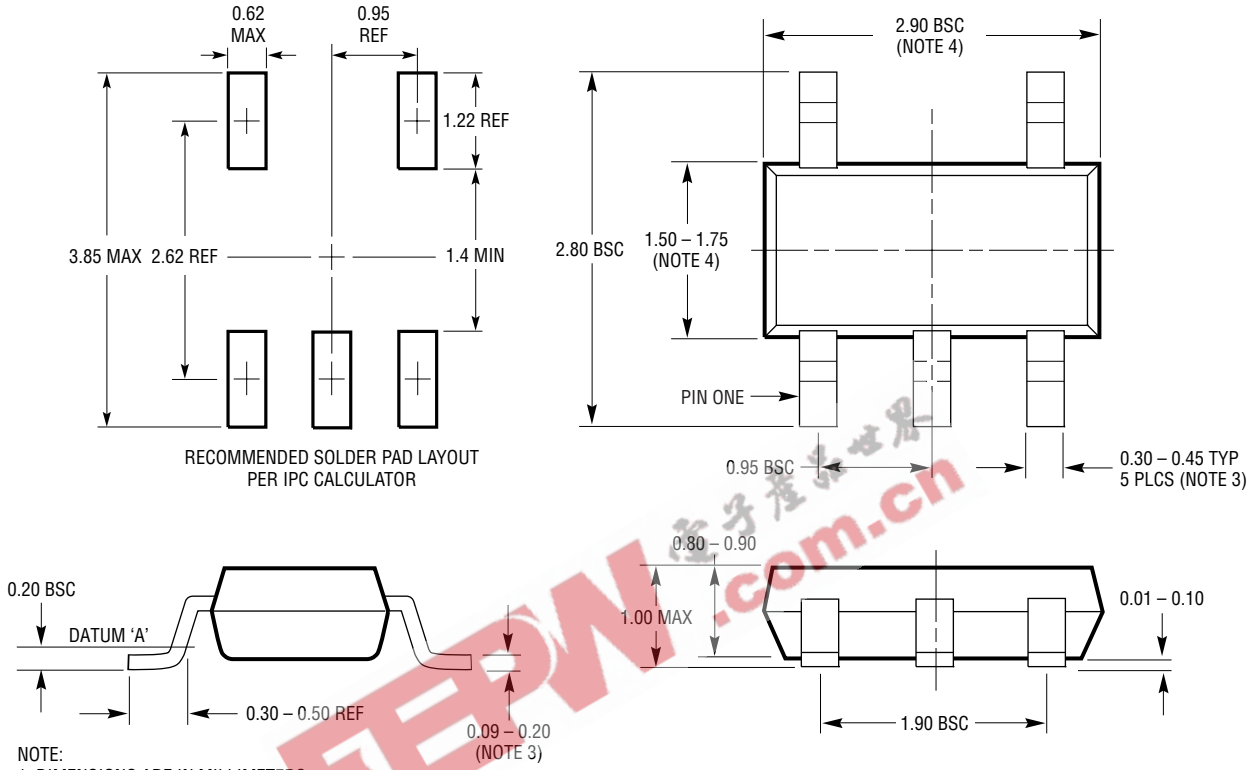






PACAGE DESCRIPTION

S5 Package
5-Lead Plastic TSOT-23(SOT23-5)



NOTE:
1. DIMENSIONS ARE IN MILLIMETERS
2. DRAWING NOT TO SCALE
3. DIMENSIONS ARE INCLUSIVE OF PLATING
4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
5. MOLD FLASH SHALL NOT EXCEED 0.254mm
6. JEDEC PACKAGE REFERENCE IS MO-193